PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Improve The Kootenai River Ecosystem

BPA project number: 9404900
Contract renewal date (mm/yyyy): 8/1999 ☒ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Kootenai Tribe of Idaho

Business acronym (if appropriate) KTOI

Proposal contact person or principal investigator:

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NPPC Program Measure Number(s) which this project addresses
10.8B.22

FWS/NMFS Biological Opinion Number(s) which this project addresses
Kootenai River white sturgeon Biological Opinion (59 FR 45989)

ESA Section 10 Permit No. PRT-798744

Bull Trout ESA Listing (62 FR 32268)

Other planning document references
EcoAnalysts, Inc. 1998. Stream Habitat Survey of Long Canyon, Parker and Trout Creeks: Tributaries to the Kootenai River, Idaho, With Special Consideration of Kokanee Spawning Habitat and Enhancement Potential. Moscow, ID.

Montana Department of Fish, Wildlife and Parks. 1997. Fisheries mitigation and implementation plan for losses attributable to the construction and operation of Libby Dam. Draft report. Kalispell, MT.

Resident Fish Manager's Caucus of the Columbia Basin Fish and Wildlife Authority (RFM-CBFWA). 1997. Multi-Year Implementation Plan for Resident Fish Protection, Enhancement and Mitigation in the Columbia River Basin. Final Draft, June 3, 1997. Columbia Basin Fish and Wildlife Authority, Portland, Oregon.

U.S Department of the Interior, Fish and Wildlife Service. 1998. White Sturgeon: Kootenai River Population Recovery Plan. Region 1, USFWS, Portland, Ore

Short description
Identify best management options in order to enhance the aquatic ecosystem and recover native populations of white sturgeon, kokanee salmon, bull trout, burbot, Westslope cutthroat trout and redband trout in the Kootenai River system.

Target species
sturgeon, kokanee salmon, bull trout, burbot, Westslope cutthroat trout and redband trout

Section 2. Sorting and evaluation

Subbasin
Work will take place in all areas of the Kootenai River Basin

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☐ Anadromous fish ☒ Resident fish ☐ Wildlife	☐ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☒ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
8806400	Kootenai River White Sturgeon Studies and Conservation Aquaculture	Co-investigator
8806500	Kootenai River Fisheries Investigation	Co-investigator
8346500	Kootenai River experimental flow releases for white sturgeon	Co-investigator

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1995	Completion of the "Kootenai River Biological Baseline Status Report"	Yes - report was used to determine baseline status and watershed assessment needs
1996	Development of a working computer simulation model of the Kootenai River system	Yes - model is used by white sturgeon recovery team for water management decisions and future research needs
1996	Completion of a one-year macroinvertebrate investigation	Yes- used to develop a comprehensive inventory of the Kootenai River aquatic ecosystem
1997	Completion of a water quality monitoring program on the Kootenai River	Compilation and analysis in process -will be used in Kootenai River watershed assessment
1998	Completion of the macroinvertebrate investigation report "Kootenai River Macroinvertebrate Investigation"	Yes - Used to answer questions concerning food availability for juvenile white sturgeon
1998	Completion of the first year of a multi-year project to survey all the tributaries of the Kootenai River	On-going
1998	Completion of the first season of evaluating biological and population parameter data for all fish species in the Kootenai River using electrofishing techniques	On-going

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Follow up on the Adaptive Environmental Assessment workshop	a	Continue to use the computer model to develop management plans for the Kootenai River
2	Continue water quality monitoring on the tributaries of the Kootenai River	a	Collect monthly water samples on each Kootenai River tributary
		b	Send all samples to an accredited water quality laboratory for analysis of nutrients, minerals and metals
		c	Include results in watershed assessment
3	Continue stream habitat surveys on all tributaries to the Kootenai River	a	Conduct a thorough inventory of the stream channels and inventory problem areas and enhancement opportunities
		b	Complete a report that provides a narrative summary of present condition, describes the nature of problem areas, provides suggestions for remediation/enhancement opprotunities, and provides maps, locations and digital images collected during inventory
		c	Document the biological (fish and macroinvertebrate) community conditions at established biological monitoring stations in the watershed.
4	Investigate the possibility of artificial fertilization of the tributaries of the Kootenai River as a habitat improvement measure	a	Conduct an extensive literature review of other stream fertilizion projects
		b	Conduct a baseline study of nutrients, primary, secondary, and tertiary production in the study streams
		c	Increase the nutrient levels in the study streams by employing artificial fertilization methods
		d	Determine the effects of artificial fertiliztion on all levels of instream productivity

5	Determine white sturgeon hatch and larval survival rates in the main channel of the Kootenai River if protected from excessive sedimentation and predation	a	Collect and incubate white sturgeon eggs in protective capsules in the main channel of the Kootenai River
		b	Determine white sturgeon egg hatch and larval survival rates
6	Provide monthly, annual and project completion reports	a	Complete and submit monthly reports and research completion reports in a thorough and timely manner
7	Assist KTOI Project 8806400 (White Sturgeon Study and Conservation Aquaculture) with Objectives 1,2,4 and 5 when needed	a	Assist with field work when needed (broodstock capture, spawning, gillnetting, kokanee surveys, and D-ring plankton netting).

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	11/1996	12/2006			5.00%
2	8/2000	7/2001			10.00%
3	6/2001	12/2001			30.00%
4	5/2000	12/2000			20.00%
5	5/2001	12/2001			15.00%
6	8/2000	7/2001			10.00%
7	8/2000	7/2001			10.00%
				Total	100.00%

Schedule constraints
Project should continue until evidence of recovery of Kootenai River ecosystem and native fish populations is assured (as outlined in USFWS 1998 recovery plan)

Completion date
This is a continuing project.

Section 5. Budget

FY99 project budget (BPA obligated): $245,598

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	3 FTE, 1 PTE (24 hr/wk)	%38	113,858
Fringe benefits	33 % of personnel	%13	37,573
Supplies, materials, non-expendable property		%2	6,286
Operations & maintenance		%1	4,000
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%0	
NEPA costs		%0	
Construction-related support		%0	
PIT tags	# of tags:	%0	
Travel		%2	5,000
Indirect costs	54.7% of personnel and fringe	%28	82,833
Subcontractor	EcoAnalysts	%15	46,130
Subcontractor	Water quality laboratory	%1	4,320
Other		%0	
TOTAL BPA FY2000 BUDGET REQUEST			$300,000

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
		%0	
		%0	
		%0	
		%0	
Total project cost (including BPA portion)			$300,000

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$325,000	$350,000	$375,000	$400,000

Section 6. References

Watershed?	Reference
☐	Anders, P.J. 1993. Kootenai River fisheries studies. Report C: Kootenai River tributary kokanee spawning ground survey. Prepared for U.S. Department of Energy, Bonneville Power Administration. Project No. 88-64.

	Portland, OR.
☒	EcoAnalysts, Inc. 1998. Stream Habitat Survey of Long Canyon, Parker and Trout Creeks: Tributaries to the Kootenai River, Idaho, With Special Consideration of Kokanee Spawning Habitat and Enhancement Potential. Moscow, ID.
☐	Northwest Power Planning Council. 1994 as amended in 1995. Columbia River basin fish and wildlife program. Portland, Oregon.
☐	Montana Department of Fish, Wildlife and Parks. 1997. Fisheries mitigation and implementation plan for losses attributable to the construction and operation of Libby Dam. Draft report. Kalispell, MT.
☐	Paragamian, V.L. 1994. Kootenai River fisheries investigation: Stock status of burbot and rainbow trout and fisheries inventory. Idaho Department of Fish and Game, Annual Progress Report FY 1994, Project No. 88-65, Boise, ID.
☐	Partridge, F. 1983. Kootenai River fisheries investigations. Idaho Department of Fish and Game. Job Completion Report, Project F-73-R-5, Boise, ID.
☐	R.L & L. Environmental Services LTD. 1997. Columbia River white sturgeon spawning studies. 1996 Data Report. Prepared for Cominco LTD. Trail Operations.
☐	Resident Fish Manager's Caucus of the Columbia Basin Fish and Wildlife Authority (RFM-CBFWA). 1997. Multi-Year Implementation Plan for Resident Fish Protection, Enhancement and Mitigation in the Columbia River
☐	Basin. Final Draft, June 3, 1997. Columbia Basin Fish and Wildlife Authority, Portland, Oregon.
☐	Richards, D.L. 1998. Kootenai River macroinvertebrate investigation. Annual Report 1997 for Bonneville Power Administration (Contract No. 95BI40364).
☐	Richards, D.L. 1997. Kootenai River biological baseline status report. Annual Report 1996 for Bonneville Power Administration (Contract No. 95BI40364).
☐	Snyder, E.B. and G.W. Minshall. 1994. Ecosystem metabolism and nutrient dynamics in the Kootenai River in relation to impoundment and flow enhancement for fisheries management. Annual Report. Stream Ecology Center, Idaho State University, Pocatel
☐	U.S Department of the Interior, Fish and Wildlife Service. 1998. White Sturgeon: Kootenai River Population Recovery Plan. Region 1, USFWS, Portland, Oregon.
☐	Woods, P.F. 1982. Annual nutrient loadings, primary productivity, and trophic state of Lake Koocanusa, Montana and British Columbia, 1972-80. Geological Survey Professional Paper 1283, United States Government Printing Office.

PART II - NARRATIVE

Section 7. Abstract

The Kootenai River ecosystem in Idaho, Montana and British Columbia (B.C) Canada has been degraded severely over the past 50 years. The aquatic ecosystem has changed from being nutrient-rich, to one that is lacking in nutrients. A few of the possible reasons for the degradation include separation of the river from its floodplain (channelization and diking), impoundment (construction and operation of Libby dam) and pollution abatement in the watershed. The interaction of these factors and the resulting trophic effects over a period of decades appear to be responsible for the collapse of the Kootenai River ecosystem, and the measurable symptoms of declining and endangered fish populations.

In the 1995 Columbia River Basin Fish and Wildlife Program (Section 10.8b.22), The NPPC calls on the Kootenai Tribe of Idaho to "Perform a five year Kootenai River ecosystem status determination and improvement study. The study should include elements that will: 1) provide a comprehensive ecosystem status report; 2) evaluate the biological feasibility of restoring system productivity; 3) identify effects of hydropower operations (Libby Dam) on aquatic biota and fish assemblages; and 4) develop, evaluate, test and analyze solutions to ecosystem problems caused by factors currently limiting system productivity, such as nutrient limitation and hydropower effects."

The overall objective for this continuing project is to identify best management options in order to enhance the aquatic ecosystem and the native fish populations to provide future harvest opportunities of white sturgeon, kokanee salmon, burbot, bull trout, Westslope cutthroat and redband trout in the Kootenai River system, historically fished by the Kootenai Tribe of Idaho.

Section 8. Project description

a. Technical and/or scientific background

The Kootenai River system is an aquatic ecosystem in the state of collapse. One possible reason for this collapse is the alteration of the natural hydrograph of the Kootenai River. Since Libby Dam began operating in the early 1970's, the Kootenai River hydrograph has been very unstable, unnatural, and virtually reversed from pre-impoundment conditions. Since impoundment, water has been retained during historical periods of high discharge, and released from Lake Koocanusa (impounded by Libby Dam) during historically low flow periods (Partridge 1983). Consequently, the last substantial naturally produced year class of white sturgeon to recruit to the Kootenai River population was produced in 1974. This white sturgeon population, endemic to the Kootenai River system, was listed as endangered under the U.S. Endangered Species Act on September 6, 1994, in part due to this lack of recruitment (59 FR 45989).

Fish populations of other species in the Kootenai River system have also declined since 1974. Kokanee salmon runs (South Arm Kootenay Lake Stock), numbering

thousands of fish as recently as the early 1980's (Partridge 1983), have declined to less than 85 fish in up to 8 historic spawning streams combined (Anders 1993). Catch rates of rainbow trout, and standing stock estimates and growth rates of mountain whitefish in the Kootenai River have declined since the early 1980's (Paragamian 1994). The burbot population in the Kootenai River has also declined during recent decades, as indicated by an ongoing burbot population study in which eight burbot were captured during 887 hours of sampling (Paragamian 1994).

Another potential reason for the decline in population densities of aquatic biota in the Kootenai River system appears to be nutrient retention in Lake Koocanusa. Woods (1982) reported that 63% of total phosphorus and 25% of nitrogen in the Kootenai River system never pass Libby Dam to provide biological benefit downstream. Lake Koocanusa (impounded by Libby Dam) is acting as a nutrient sink, trapping sediment with efficiencies exceeding 95%, and storing nutrients in the bottom substrates (Snyder and Minshall 1994, Woods 1982).

In the 1995 Columbia River Basin Fish and Wildlife Program (Section 10.8b.22), The NPPC calls on the Kootenai Tribe of Idaho to "Perform a five year Kootenai River ecosystem status determination and improvement study. The study should include elements that will: 1) provide a comprehensive ecosystem status report; 2) evaluate the biological feasibility of restoring system productivity; 3) identify effects of hydropower operations (Libby Dam) on aquatic biota and fish assemblages; and 4) develop, evaluate, test and analyze solutions to ecosystem problems caused by factors currently limiting system productivity, such as nutrient limitation and hydropower effects." (Northwest Power Planning Council Fish and Wildlife Program 1994 as amended in 1995).

The objective for this continuing project is to identify best management options in order to ultimately enhance the aquatic ecosystem and provide future harvest opportunities of white sturgeon, kokanee salmon, burbot, bull trout, Westslope cutthroat trout and redband trout in the Kootenai River system, historically fished by the Kootenai Tribe of Idaho. River and tributary habitat assessment, along with analysis of contaminants in soil and invertebrates, which is proposed for fiscal year 1999 (beginning August 1999), is essential prior to developing management options for the Kootenai River ecosystem.

Fiscal year 1995 ended with the completion of the "Kootenai River Biological Baseline Status Report" (Richards 1997) which was produced through a combination of literature review and synthesis. From this compilation of data, it was determined that there was a considerable lack of data for the invertebrates in the Kootenai River, therefore an invertebrate study was initiated for the following year in order to develop a complete and thorough data-base for the Kootenai River.

A one-year macroinvertebrate investigation, which was implemented in order to help develop a comprehensive inventory of the Kootenai River aquatic ecosystem was completed at the end of fiscal year 1996. Macroinvertebrates are one of the most important lower trophic organisms in river ecology because they are the link between nutrient supply and food availability for fish. This investigation was designed to investigate the idea that a lack of macroinvertebrate forage for juvenile white sturgeon could be a contributing factor to the population's decline. I t was found that where the sturgeon spawn (downstream of Bonners Ferry, ID), there were high numbers of invertebrate types that are preferred by juvenile white sturgeon (Chironomidae and

Oligochaetes). When comparing the results from this study to those obtained on the Snake River (contains naturally reproducing white sturgeon), it was assumed that overall benthic densities in the Kootenai River are high enough to support a naturally reproducing population of white sturgeon in the juvenile life stage. Less is known about the dietary needs of larval sturgeon or the availability of food for this life stage. Specific results of this study can be found in the final report "Kootenai River Macroinvertebrate Investigation" (Richards, 1998).

A Kootenai River predictive model, incorporating empirical Kootenai River biological data, was also developed during fiscal year 1996, through a series of Adaptive Environmental Assessment (AEA) workshops. Throughout these workshops, international, federal, provincial, state, and tribal agencies cooperated in the exchange of data, ideas and concerns, in order to create a working computer simulation model of the Kootenai River system. The completed model provides a better understanding about the system, and is being used to make quantitative predictions about the response of the system to various management options. The Recovery Team used the AEA results to help in the development of the final Sturgeon Recovery Plan (USFWS 1998). The U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (USACE) will also be referring to the AEA model for water management decisions. The AEA model will continue to be used by different agencies throughout the recovery of the white sturgeon and many other fish populations.

In 1998, a stream habitat survey was conducted on three tributaries of the Kootenai River in Boundary County, Idaho. The objectives of the survey were to determine the availability of suitable habitat for fish species that use the stream to spawn, determine potential sources of perturbation to the streams, and evaluate sites for potential enhancement or remediation opportunities. This survey marks the first year of a multi-year plan to survey all the tributaries of the Kootenai River. The information obtained from the surveys will be necessary for the development of enhancement measures that will not only improve spawning habitat, but rearing habitat as well for many fish species including white sturgeon, kokanee salmon, burbot, bull trout, Westslope cutthroat and redband trout. Results of this first survey can be found in "Stream Habitat Survey of Long Canyon, Parker and Trout Creeks: Tributaries to the Kootenai River, Idaho, with Special Consideration of Kokanee Spawning Habitat and Enhancement Potential" (EcoAnalysts, 1998).

b. Rationale and significance to Regional Programs

This project's objectives and hypotheses are related to the Fish and Wildlife Plan (Northwest Power Planning Council 1994 as amended in 1995) objectives and measures because they are specifically directed toward evaluating and enhancing the Kootenai River aquatic ecosystem. In the 1995 Columbia River Basin Fish and Wildlife Program (Section 10.8b.22), The NPPC calls on the Kootenai Tribe of Idaho to "Perform a five year Kootenai River ecosystem status determination and improvement study. The study should include elements that will: 1) provide a comprehensive ecosystem status report; 2) evaluate the biological feasibility of restoring system productivity; 3) identify effects of hydropower operations (Libby Dam) on aquatic biota and fish assemblages; and 4) develop, evaluate, test and analyze solutions to ecosystem problems caused by factors

currently limiting system productivity, such as nutrient limitation and hydropower effects." (Northwest Power Planning Council Fish and Wildlife Program 1994 as amended in 1995).

The objectives and hypotheses of this project are related to the Multi-Year Implementation Plan (MYIP) because they evaluate and "restore healthy ecosystems which preserve functional links among biota to ensure the continued persistence, health and diversity of all species including game fish species, nongame fish species, and other organisms" (RFM-CBFWA 1997).

This goals of this project follow the actions needed to initiate white sturgeon recovery in the Kootenai River white sturgeon final recovery plan (1998). The recovery plan states that white sturgeon habitats need to be identified and restored in order to sustain white sturgeon reproduction (spawning and early age recruitment) and rearing, while minimizing impacts on other uses of Kootenai River basin waters. The effects of contaminants and possible additional biological threats e.g. predation, altered species composition, on Kootenai River white sturgeon and their habitats also need to be evaluated. Finally, the condition of white sturgeon spawning and incubation habitat quality and potential substrate improvement must be assessed. This project is very important to the recovery of many fish species because it focuses on determination of potential sources of spawning and rearing habitat degradation and then employs enhancement measures to rehabilitate these habitats. Lower Kootenai River tributary assessment and restoration is a vital step in the improvement of the main-stem Kootenai River fishery. Enhancing the quality of the lower Kootenai River tributaries is not only beneficial to white sturgeon, kokanee and bull trout populations, but other fish species as well that have been experiencing a general decline over the past 50 years. If this project is not funded, the population of many fish species will continue to decrease to a point where they may be impossible to recover.

The goals and objectives of this continuing Kootenai River ecosystem enhancement project are also closely related to the goals of the Kootenai River Network. The Kootenai River Network (KRN) is an alliance between various citizen's groups, individuals, business and industry, and tribal and government water resources management agencies in Montana, Idaho, and British Columbia. The KRN is working, through cooperative efforts, to improve resource management practices and to restore water quality and aquatic resources in the Kootenai River Basin.

In June 1998, the KRN participants selected a contracting company to develop a comprehensive water quality monitoring plan for the Kootenai River Basin. Many different agencies working in the basin feel that the amount of accurate water quality information and level of monitoring is inadequate to appropriately guide management decisions. There is a need to identify data gaps and to develop a comprehensive water quality monitoring program throughout the Kootenai River basin that will utilize the resources and expertise of private citizens, organizations, tribes and agencies in Montana, Idaho and British Columbia. The water quality monitoring project is scheduled to be completed by July 1999.

c. Relationships to other projects

This project is part of the overall recovery plan for white sturgeon, which also includes recovery of other native species in the Kootenai River drainage (USFWS 1998). Several other projects in the drainage address other important aspects of recovery. KTOI project 8806400 deals with conservation aquaculture and monitoring and evaluation of the white sturgeon hatchery releases. IDFG Project 8806500 assesses natural spawning of the white sturgeon and MFWP Project 8346500 develops and refines experimental flow releases for sturgeon. In the recovery plan, the following measures are considered Priority 1 actions to be implemented immediately: 1) augment flows of the Kootenai river to enhance natural reproduction; 2) implement a conservation aquaculture program to prevent extinction; and 3) re-establish suitable habitat conditions to increase the chances of survival past the egg/larval stage. This project directly addresses the priority action (#3), and in conjunction with the other projects in the basin, is necessary for the recovery of native species in the Kootenai River drainage.

All work is coordinated through the white sturgeon recovery team and the other project managers in order to eliminate redundancy and focus on an adaptive management approach. This project is a component of many different programs working concurrently together. Other relationships are summarized below.

NRCS frequently contacts KTOI concerning the wetlands reserve program, stream rehabilitation, and conservation easements in the Kootenai drainage. We have discussed partnerships for conservation efforts in the Kootenai River drainage.

The goals and objectives of this continuing Kootenai River ecosystem enhancement project are also closely related to the goals of the Kootenai River Network. The Kootenai River Network (KRN) is an alliance between various citizen's groups, individuals, business and industry, and tribal and government water resources management agencies in Montana, Idaho, and British Columbia. The KRN is working, through cooperative efforts, to improve resource management practices and to restore water quality and aquatic resources in the Kootenai River Basin.

During fiscal year 1999, the Kootenai Tribe will be working with the Idaho Fish and Game to gather contaminant data on sediments and invertebrates so that a management plan can be developed that will preserve and enhance the aquatic resources of the Kootenai River.

The tributary work on the lower Kootenai River has been coordinated by the KTOI in cooperation with private landowners. All the lower portions of the tributaries on the lower Kootenai River are on private land. Private landowner cooperation is important to the successful rehabilitation of the lower tributaries.

All work has been accomplished through the necessary permitting process. A Section 10 permit has been issued to KTOI by the USFWS for Incidental Take. A collection permit is issued through IDFG for all fisheries work. Coordination among the

agencies and the Tribe is ongoing and necessary for any work performed in the Kootenai River ecosystem.

d. Project history (for ongoing projects)

Adaptive management implications

A Kootenai River predictive model, incorporating empirical Kootenai River biological data, was also developed during fiscal year 1996, through a series Adaptive Environmental Assessment (AEA) workshops. Throughout these workshops, international, federal, provincial, state, and tribal agencies cooperated in the exchange of data, ideas and concerns, in order to create a working computer simulation model of the Kootenai River system. The completed model provides a better understanding about the system, and is being used to make quantitative predictions about the response of the system to various management options. The Recovery Team used the AEA results to help in the development of the Sturgeon Recovery Plan (USFWS 1998). The U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (USACE) will also be referring to the AEA model for water management decisions. The AEA model will continue to be used by different agencies throughout the recovery of the white sturgeon and many other fish populations.

In 1998, a stream habitat survey was conducted on three tributaries of the Kootenai River in Boundary County, Idaho. The objectives of the survey were to determine the availability of suitable habitat for fish species that use the stream to spawn, determine potential sources of perturbation to the streams, and evaluate sites for potential enhancement or remediation opportunities. This survey marks the first year of a multi-year plan to survey all the tributaries of the Kootenai River. The information obtained from the surveys will be used to develop enhancement measures that will not only improve spawning habitat, but rearing habitat as well for many fish species including white sturgeon, kokanee salmon, burbot, bull trout, Westslope cutthroat and redband trout.

Project reports and technical papers

Kootenai River Biological Baseline Status Report (Richards 1997).

Kootenai River Macroinvertebrate Investigation (Richards 1998).

Stream Habitat Survey of Long Canyon, Parker and Trout Creeks: Tributaries to the Kootenai River, Idaho, with Special Consideration of Kokanee Spawning Habitat and Enhancement Potential (EcoAnalysts 1998).

Implications of Ecosystem Collapse on White Sturgeon (*Acipenser transmontanus*) in the Kootenai River, Idaho, Montana and British Columbia (Anders and Richards, in press).

Years underway

This project is currently in its fourth year (FY 98)

Summary of major results achieved

Fiscal year 1995 ended with the completion of the "Kootenai River Biological Baseline Status Report" (Richards 1997) which was produced through a combination of literature review and synthesis. From this compilation of data, it was determined that there was a considerable lack of data for the invertebrates in the Kootenai River, therefore an invertebrate study was initiated for the following year in order to develop a complete and thorough data-base for the Kootenai River.

A one-year macroinvertebrate investigation, which was implemented in order to help develop a comprehensive inventory of the Kootenai River aquatic ecosystem was completed at the end of fiscal year 1996. Macroinvertebrates are one of the most important lower trophic organisms in river ecology because they are the link between nutrient supply and food availability for fish. This investigation was designed to investigate the idea that a lack of macroinvertebrate forage for juvenile white sturgeon could be a contributing factor to the population's decline. It was found that where the sturgeon spawn (downstream of Bonners Ferry, ID), there were high numbers of invertebrate types that are preferred by juvenile white sturgeon (Chironomidae and Oligochaetes). When comparing the results from this study to those obtained on the Snake River (contains naturally reproducing white sturgeon), it was assumed that overall benthic densities in the Kootenai River are high enough to support a naturally reproducing population of white sturgeon (juvenile age 2+). Less is known about the food habits of larval sturgeon and whether the system has the appropriate nutrients to support them. Specific results of this study can be found in the final report "Kootenai River Macroinvertebrate Investigation" (Richards, 1998).

A Kootenai River predictive model, incorporating empirical Kootenai River biological data, was also developed during fiscal year 1996, through a series of Adaptive Environmental Assessment (AEA) workshops. Throughout these workshops, international, federal, provincial, state, and tribal agencies cooperated in the exchange of data, ideas and concerns, in order to create a working computer simulation model of the Kootenai River system. The completed model provides a better understanding about the system, and is being used to make quantitative predictions about the response of the system to various management options. The Recovery Team is using the AEA results to help in the development of the final Sturgeon Recovery Plan. The U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (USACE) will also be referring to the AEA model for water management decisions. The AEA model will continue to be used by different agencies throughout the recovery of the white sturgeon and many other fish populations.

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redband trout. Out of the three tributaries that were surveyed in this first year, one of them did not have suitable spawning habitat, and the other two have spawning habitat that is under-utilized. Perturbations to the three streams include dike construction and channelization for flood control, discharges from drainage ditches, and cattle grazing. Results of this first survey can be found in "Stream Habitat Survey of Long Canyon, Parker and Trout Creeks: Tributaries to the Kootenai River, Idaho, with Special Consideration of Kokanee Spawning Habitat and Enhancement Potential" (EcoAnalysts, 1998).

Past costs

1995 - $175,000
1996 - $232,353
1997 - $223,858
1998 - $250,000
1999 - $245,598

* This project (9404900) will not begin fiscal year 1999 until August 1999.

e. Proposal objectives

Objective 1 Follow up on the Adaptive Environmental Assessment workshop

The computer model that was developed through the Adaptive Environmental Assessment process in 1997 will continue to be used by different agencies to develop management plans throughout the recovery of the white sturgeon and other fish populations. Meeting coordination, facilitation, and updating model with new data may be necessary.

Objective 2 Continue water quality monitoring on the tributaries of the Kootenai River

This objective is closely related to the Fish and Wildlife Plan (Northwest Power Planning Council 1994 as amended in 1995) objectives and measures because it is specifically directed toward evaluating the Kootenai River aquatic ecosystem, which must take place before any ecosystem enhancement measures can be developed. This objective is also a precursor to the Multi-year Implementation Plan (MYIP) objective, which is to "restore healthy ecosystems which preserve functional links among biota to ensure the continued persistence, health and diversity of all species including game fish species, nongame fish species, and other organisms" (RFM-CBFWA 1997). The white sturgeon recovery plan (1998) states that the effects of contaminants and possible additional biological threats e.g. predation, altered species composition, on Kootenai River white sturgeon and their habitats need to be evaluated, along with the determination of potential sources of spawning and rearing habitat degradation. This objective addresses these measures. Water quality monitoring will be incorporated into stream habitat and fish surveys for watershed assessments..

Objective 3 Continue stream habitat surveys on all tributaries to the Kootenai River

This objective is related to the Multi-Year Implementation Plan (MYIP) because the main goal of conducting stream surveys is to evaluate and "restore healthy ecosystems which preserve functional links among biota to ensure the continued persistence, health and diversity of all species including game fish species, nongame fish species, and other organisms" (RFM-CBFWA 1997). It is also related to the Fish and Wildlife Plan (Northwest Power Planning Council 1994 as amended in 1995) objectives and measures because it is directed toward evaluating and enhancing the Kootenai River aquatic ecosystem. The results of these habitat surveys will be essential prior to the development of enhancement measures for impaired streams.

Objective 4 Investigate the possibility of artificial fertilization of the tributaries of the Kootenai River as a habitat improvement measure

This objective is closely related to the Multi-Year Implementation Plan (MYIP) because it evaluate and "restore healthy ecosystems which preserve functional links among biota to ensure the continued persistence, health and diversity of all species including game fish species, nongame fish species, and other organisms" (RFM-CBFWA 1997). It is also follows the Fish and Wildlife Plan (Northwest Power Planning Council 1994 as amended in 1995) objectives and measures because it is directed toward evaluating and enhancing the Kootenai River aquatic ecosystem. More specifically, in the 1995 Columbia River Basin Fish and Wildlife Program (Section 10.8b.22), the Northwest Power Planning Council calls on the Kootenai Tribe of Idaho to "Perform a five year Kootenai River ecosystem status determination and improvement study, which includes evaluating the biological feasibility of restoring system productivity as one of the major elements of the program (Northwest Power Planning Council Fish and Wildlife Program 1994 as amended in 1995).

Objective 5 Determine white sturgeon hatch and larval survival rates in the main Channel of the Kootenai River if protected from excessive sedimentation and predation

The Kootenai River predictive model that was developed through a series of Adaptive Environmental Assessment workshops in 1997 shows that the impact of predation on white sturgeon is so great, that there is no way to numerically override its effects. The model also states that if there is at least 10% predation, then no matter what changes are made to the other factors possibly affecting the sturgeon population, there will be no recruitment of white sturgeon to the natural population. Some reasons for the possible dramatic effects caused by predation include channelization of the Kootenai River and loss of side channel rearing habitat due to diking, and a decrease in total water volume due to the construction and operation of Libby Dam in 1974. Diking of the river virtually eliminated rearing habitat for larval sturgeon and other fish, so they must remain in the main channel of the river where they are most vulnerable to predation. In addition,

predators are in a smaller area because of the reduction in water volume, which makes the larval fish more apt to be fed upon.

In order to determine if predation may be a factor in the decrease of natural recruitment to the white sturgeon population, it will be important to try and eliminate the effects of predation while measuring sturgeon hatch and larval survival rates. White sturgeon eggs will be placed in incubation capsules (protected from predation and excessive sedimentation) in the main channel of the Kootenai River. The results of this experiment will be important in determining which factors may be affecting white sturgeon in their early life stages. If there is adequate hatching and larval survival rates, than it is possible that predation and/or suffocation by excessive sediment could be affecting wild sturgeon in their early life stages. In addition, if the hatch and survival rates are high, than it could be assumed that water quality probably does not have a large affect on wild sturgeon in their early life stages.

f. Methods

Objective 1 Follow up on the Adaptive Environmental Assessment workshop

Objective 2 Continue water quality monitoring on the tributaries of the Kootenai River

The continuation of the tributary water quality monitoring will be funded through Upper Columbia United Tribes (UCUT) for $10,000.

Task (a) will be to collect water samples on twelve tributaries of the Kootenai River. Two samples will be taken on each tributary, one at the mouth and the other at some distance upstream from a known non-point pollution source. A two person crew will travel to the mouth of each tributary by boat, while another individual collects samples at all upstream sites. Two randomly selected duplicate samples will also be collected. Physical water quality parameters will also be collected at the mouths of each tributary using a Hydrolab Surveyor 3 ® instrument.

Task (b) will be to send all water samples via Fed Ex overnight to an accredited laboratory to be analyzed for nutrients, minerals and metals.

Objective 3: Continue stream habitat surveys on all tributaries to the Kootenai River.

Task (a) will be to conduct a thorough inventory of the stream channels and inventory problem areas and enhancement opportunities. In June 2000, a two person crew will walk the entire length of each designated stream (particular streams will be determined closer to the initiation date of the project) working upstream from the confluence of each stream with the Kootenai River. The crew will record all points of interest (POI) which include potential fish spawning gravels, fish barriers, bank failures, potential pollution or sediment inputs, and changes in stream characteristics such as gradient and dominant substrate. A digital camera and handheld GPS unit will be used to document the nature and location of problems and enhancement opportunities.

Task (b) will be to complete a report that provides a narrative summary of present condition, describes the nature of problem areas, provides suggestions for remediation/enhancement opportunities, and provides maps, locations and digital images collected during inventory. From this report a priority list of enhancement projects can be generated.

Task (c) will be to document the biological (fish and macroinvertebrate) community conditions at established biological monitoring stations in the watershed once the report has been completed. Documenting the biological community will help determine the effectiveness of any enhancement projects that may take place in the future.

Objective 4: Investigate the possibility of artificial fertilization of the tributaries of the Kootenai River as a possible habitat enhancement measure

This objective will be the first year of a three year project. It will consist of compiling baseline data that will build on the data collected during the surveys. Once a stream is classified as being impaired, as determined from the initial tributary surveys conducted, and artificial fertilization looks like it may be beneficial as an enhancement method, then more extensive data collection will take place.

Task (a) will be to conduct an extensive literature review of other stream fertilization projects and their results. Much of this information will come from watershed restoration projects taking place in British Columbia, Canada.

Task (b) will be to conduct a baseline study of nutrients, primary, and tertiary production in the study streams. Two sites will be chosen above and below the projected fertilization point in each stream to monitor nutrients, primary and tertiary production. Sampling will take place once a month from May 2000 to October 2000. One water quality sample plus three replicates will be collected from each site on each study stream every month. The samples will be sent Fed Ex overnight to an accredited water quality laboratory to be analyzed for nutrients. Periphyton and macroinvertebrates will be collected at the same four sites as the water samples, with three replicates per site. The subcontractor will analyze these samples. The subcontractor will also conduct fish production (population and biomass) estimates on the study streams. The fish inventory will take place at all the study sites only one time during the study period. All analyses will be summarized in a final report.

After all the baseline data is analyzed and it is decided to that fertilization would be a good method for enhancing the stream habitat, then the second year will consist of increasing nutrient levels in the chosen streams through employment of artificial fertilization methods. The third and final year will consist of monitoring the effects (if any) of the enhancement efforts, by looking at all levels of production in the study streams.

Objective 5: Determine white sturgeon hatch and larval survival rates in the main channel of the Kootenai River if protected from excessive sedimentation and predation.

Task (a) will be to collect and incubate white sturgeon eggs in protective capsules in the main channel of the Kootenai River. The methods will be similar to those stated in R.L. and L. Environmental Services LTD. (1997), where the objective was to develop incubation procedures that could be used to quantify the effects of higher than optimal egg development temperatures on white sturgeon egg development and larval viability. Three incubation capsules will be attached to an incubation line, which consists of a 25 m length of rope and concrete anchors at each end of the rope to help stabilize the incubation line on the river bottom. The line will be positioned from upstream to downstream. The upstream end will be secured to the river bank, and a buoy will be attached to the downstream anchor to serve as a backup method of retrieval in case the line became unattached from the bank.

Eggs will be collected during spawning at the Kootenai Tribal Hatchery and transferred to incubation capsules. One layer of gravel will be placed in the bottom of a capsule to keep eggs physically separated and to simulate a more natural interstitial incubation environment, while providing interstitial spaces so the eggs will not be crushed. Approximately ten eggs will be placed on the first layer of gravel, and then two more layers of gravel and eggs will be added in the same manner.

This entire operation will be conducted with the capsule submerged in river water to help cushion the eggs from mechanical shock and reduce exposure to the air. Five incubation lines will be employed over the course of the spawning period and left undisturbed until sufficient amount of time for the eggs to hatch. Each capsule will then be checked as quickly and carefully as possible, and the number of larval sturgeon present will be documented. Each capsule will be reset and larval sturgeon will be left in the river for a period of time to determine larval survival rates. The river temperature at the incubation sites will be monitored throughout the experiment to monitor whether or not the temperature remains in the range considered best for optimal egg development.

Task (b) will be to determine white sturgeon egg hatch and larval survival rates. Sturgeon hatch rates will be figured as the number of larvae (living plus dead), divided by the number of total eggs minus the unhatched live eggs. Larval survival rates will be calculated as the number of live larvae divided by the total number of larvae (live plus dead).

Objective 6: Provide monthly, annual and project completion reports

Objective 7: Assist KTOI Project 8806400 (White Sturgeon Study and Conservation Aquaculture) with Objectives 1,2,4 and 5 when needed.

This is a KTOI Project 8806400 objective. Project 8806400 has eliminated the temporary Monitoring and Evaluation technician positions from the budget. Effort will be coordinated with project managers. A description of sampling methods can be found in Project 8806400 proposal (broodstock capture, spawning, gillnetting, kokanee surveys, and D-ring plankton netting).

g. Facilities and equipment

The Kootenai Tribe has a 18 foot aluminum Starcraft boat and a Chevy Tahoe that will be used to get to and from the for incubation sites and to collect water quality samples from the tributaries.

The tribe also has a Hydrolab Surveyor 3 ® instrument that is needed to collect physical water quality parameters on the tributaries that are sampled.

The subcontractor will provide the digital camera and hand-held GPS unit needed to conduct the stream surveys.

The Kootenai Tribe of Idaho currently has incubation capsules, so those will not have to be purchased for the white sturgeon egg and larval survival rate experiment.

A Gateway 2000 IBM compatible computer will be used for any statistical analyses, graphing and report writing.

h. Budget

Subcontractor

Accredited water quality laboratory

Water quality sampling for objective 4 (investigate the possibility of artificial fertilization of the tributaries) of the project will cost **$4,320**. There will be 24 samples taken each month for 6 months at $30/sample for analysis. Shipping of the samples for 6 months will be $200.

EcoAnalysts

The continuation of the stream surveys (objective 3) will be **$14,010**. The compilation of existing tributary information, field inventory, and fish surveys will require a two person crew for 15 days at $534/day, which total $8,010. The field inventory and survey report will cost $2,500 and the macroinvertebrate sampling report will cost $3,500.

Objective 4, minus the water quality sampling, will cost **$32,120**. Periphyton and macroinvertebrate analysis will be a total of $17,280 ($8,640 each). There will be 12 samples of both periphyton and macroinvertebrates collected each month for 6 months at $120/sample for analysis. Fish production (population and biomass) estimates will cost $500. Inventory will take place at four sites, once during the six month period, at $125/site. A two person crew will be collecting all samples and conducting the fish production estimates at $534/day for 10 days, which would be $5,340. Literature review and report writing will take approximately 200 hours at $45/hour, which would be $9,000.

Section 9. Key personnel

Chris Lewandowski
Fisheries Biologist/Limnologist Technician
40 hrs/wk
Duties: sample collection; identification and analysis of field samples (invertebrate and fish stomach contents); data entry into computer; statistical analysis and graphing of data; assist with study design.

Ralph Bahe
Fisheries Biologist/Limnologist Technician
40 hrs/wk
Duties: sample collection; identification and analysis of field samples (invertebrate and fish stomach contents); data entry into computer; statistical analysis and graphing of data; assist with study design.

Diana Richards
Master of Science, Biology - 1994
Eastern Washington University
Cheney WA 99004
Concentration: Limnology, Water Pollution Biology
Bachelor of Science, Biology - 1992
Eastern Washington University
Cheney WA 99004
Concentration: General Biology, Chemistry

Experience:

Nov. 1995 to Present — KOOTENAI TRIBE OF IDAHO
Fisheries Biologist/Limnologist – 40 hrs/wk
- Experience with annual contract responsibilities
- Develop annual budgets
- Coordinate aquatic ecosystem enhancement projects
- Make project purchases and expenditures within budgeted amounts
- Interview, recommend and train new full-time and temporary employees
- Assign work responsibilities and projects to employees
- Lead small field research crews through annual sampling regimes
- Supervise full-time and temporary employees
- Involved with interagency scientific, political and public correspondence
- Interact with staff from diverse backgrounds
- Organize, analyze and interpret data
- Formulate progress and annual reports according to contract obligations

July 1995 to Nov. 1995 — INLAND EMPIRE PAPER COMPANY
Laboratory Assistant – 40 hrs/wk
- Performed nutrient and turbidity tests on paper mill effluent
- Performed water quality tests on the river receiving mill effluent
- Performed brightness, strength, and fiber content tests on paper pulp
- Organized, analyzed and interpreted data
- Entered data into computer
- Summarized project results

Sept. 1992 to — EASTERN WASHINGTON UNIVERSITY

July 1995 LIMNOLOGY LABORATORY

Research Associate – 40 hrs/wk

- Co-authored progress and annual research reports
- Operated various field and laboratory equipment
- Collected water quality samples
- Analyzed water samples in a laboratory
- Organized, analyzed and interpreted data
- Communicated test results and environmental issues to clients
- Practiced quality assurance and quality control measures
- Obtained knowledge of word processing and spreadsheet software

Sept. 1988 to Sept. 1992 UPPER COLUMBIA UNITED TRIBES FISHERIES CENTER

Research Assistant – 30 hrs/wk

- Co-authored progress and annual research reports
- Supervised hourly employees
- Assessed fish populations through electrofishing
- Identified and analyzed aquatic invertebrates and zooplankton samples
- Analyzed fish scales
- Operated various field and laboratory equipment
- Acquired considerable knowledge of computer software
- Organized, analyzed and interpreted data
- Worked with Native Americans on environmental assessment projects

Technical Reports

Richards, D.L. 1998. Kootenai River macroinvertebrate investigation. Annual Report 1997 for Bonneville Power Administration (Contract No. 95BI40364).

Richards, D.L. 1997. Kootenai River biological baseline status report. Annual Report 1996 for Bonneville Power Administration (Contract No. 95BI40364).

Soltero, R.A., D.L. Richards and L.M. Sexton. 1996. Water quality at selected streams within the Sacheen Lake, WA watershed with emphasis on sources of non-point phosphorus loading. Eastern Washington University, Cheney. 135 pp.

Soltero, R.A., D.J. Lantzer, L.M. Sexton, L.F. Dawes and D.L. Richards. 1995. Water quality of Sacheen Lake, WA prior to whole lake herbicide application. Washington State Department of Ecology (Grant No. G9300167). Eastern Washington University, Cheney. 233 pp.

Soltero, R.A., L.M. Sexton, D.J. Lantzer, L.F. Dawes, D.L. Richards, J.P. Buchanan and N.M. Aziz. 1995. Baseline water quality investigation of West Medical Lake, WA prior to receiving advanced wastewater treatment plant effluent. Completion

report for the City of Medical Lake (Contract No. 003295). Completion report. Eastern Washington University, Cheney. 329 pp.

Publications

Anders, P.J. and D.L. Richards. 1996. Implications of ecosystem collapse on white sturgeon (*Acipenser transmontanus*) in the Kootenai River, Idaho, Montana, and British Columbia. American Fisheries Society. In press.

Section 10. Information/technology transfer

Technical information obtained from this project will be distributed through final project reports submitted to the Bonneville Power Administration. Some of the studies may also be published in various fisheries journals. The work done on the Kootenai River predictive model through the Adaptive Environmental Assessment workshop in 1997 can be downloaded off the University of British Columbia fisheries centre web server at http://fisheries.com. As new knowledge is gained, the information will be used to guide future efforts of recovery of the Kootenai River ecosystem in an adaptive management approach. Information is presented at regional and national fisheries symposiums, local conservation and sportsmen's groups, and other appropriate forums as the opportunity arises.

Congratulations!